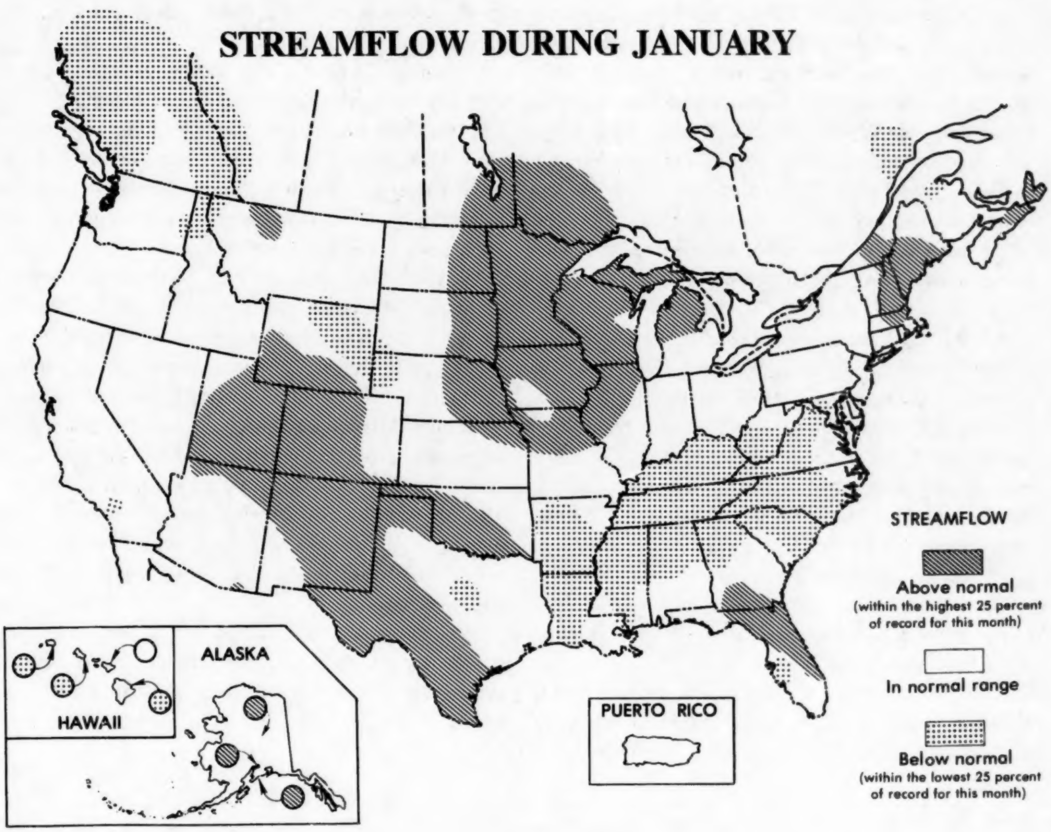
National Water Conditions

UNITED STATES
Department of the Interior
Geological Survey

CANADA
Department of the Environment
Water Resources Branch

JANUARY 1986

STREAMFLOW DURING JANUARY



Streamflow generally increased in British Columbia, the Pacific coast States, Nevada, Nebraska, Florida, Connecticut, Massachusetts, New Hampshire, Maine, and Nova Scotia. Flows generally changed variably in Idaho, North Dakota, Texas, and New Brunswick, remained unchanged in South Dakota, and generally decreased in the rest of the United States and Canada. About 74 percent of the index stations had flows in the normal to above-normal range, down from the 86 percent in those ranges for December.

Contents of 74 percent of reporting reservoirs were at or above average for the end of January and only 22 percent recorded a significant decline in contents during January. Significant declines in contents occurred at only three reservoirs which had below-average contents.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged 803,500 cubic feet per second (cfs) during January, 47 percent below last month, and 16 percent below median. The flow of the Mississippi River at Vicksburg, Mississippi (drainage area 1,140,500 square miles), dropped sharply from 1,184,200 cfs (a December record high) to 476,200 cfs, only 74 percent of median.

STREAMFLOW CONDITIONS DURING JANUARY 1986

Streamflow generally decreased in most of the United States and southern Canada: seasonally in Alaska, Alberta, Saskatchewan, Montana, Wyoming, Utah, Colorado, New Mexico, Kansas, Oklahoma, Ontario, Minnesota, Iowa, Missouri, Arkansas, Wisconsin, Illinois, Michigan, Ohio, Quebec, Vermont, New York, Rhode Island, New Jersey, and Puerto Rico; contraseasonally in Hawaii, Arizona, Louisiana, Indiana, Kentucky, West Virginia, Virginia, Tennessee, the Carolinas, Mississippi, Alabama, and Georgia; variably in Pennsylvania. Flows generally increased seasonally in the Pacific coast States, Nevada, Florida, and Massachusetts; contraseasonally in British Columbia, Nebraska, Nova Scotia, Maine, New Hampshire, and Connecticut. Flows generally changed variably in Idaho, North Dakota, Texas, and New Brunswick, but remained unchanged in South Dakota. About 74 percent of the index stations had flows in the normal to above-normal range, down from the 86 percent in those ranges for December.

Below-normal streamflow persisted in parts of Hawaii, British Columbia, Montana, Wyoming, South Dakota, Nebraska, Texas, Tennessee, Alabama, Florida, New York, and Quebec. Flows decreased into the below-normal range in Kentucky, and also in parts of California, British Columbia, Alberta, Montana, Idaho, Washington, New Brunswick, Maryland, West Virginia, the Carolinas, Tennessee, Georgia, Alabama, Mississippi, Arkansas, and Louisiana.

Above-normal flows persisted in much of the upper Midwest and also in parts of Alaska, Montana, Wyoming, Utah, Colorado, Arizona, New Mexico, Texas, Oklahoma, Florida, and Georgia. Flows moved into the above-normal range in New Hampshire and parts of adjacent States and Quebec, and also in parts of Nova Scotia, Texas, Colorado, Utah, Wyoming, and Alaska.

New monthly extremes were recorded at five index stations as given in the table on page 3.

Flood stages, as designated by the National Weather Service, were exceeded on many rivers and small streams in Oregon, Idaho, California, Nebraska, Texas, Arkansas, Louisiana, Illinois, Maine, New Hampshire, Vermont, Connecticut, Pennsylvania, South Carolina, and Florida.

Contents of 74 percent of reporting reservoirs were at or above average for the end of January and only 22 percent recorded a significant decline in contents during January. Significant declines in contents occurred at only three reservoirs which had below-average contents; International Amistad and International Falcon in Texas; High Rock Lake in North Carolina.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged 803,500 cubic feet per second (cfs) during January, 47 percent below last month, and 16 percent below median. The flow of the Mississippi River at Vicksburg, Mississippi (drainage area 1,135,500 square miles), dropped sharply from 1,184,200 cfs (a December record high) to 476,200 cfs, only 74 percent of median. These three large river systems account for runoff from more than half the conterminous United States and provide a useful check on the status of the Nation's surface-water resources.

The hydrographs on page 3 show flow conditions during the past 6 months as highly variable in Washington, persistently above-normal in New Mexico, variable in Vermont, and relatively normal in Ohio.

CONTENTS

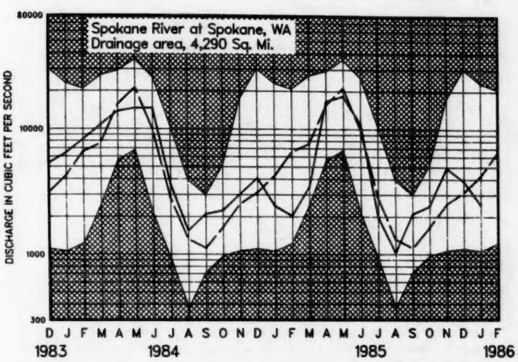
[EDITOR'S NOTE: A new term, *contraseasonal*, is used in describing streamflow conditions. This term is defined in the newly revised *Explanation of Data.*]

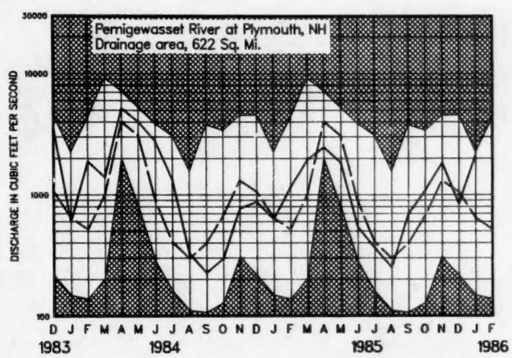
NEW EXTREMES DURING JANUARY 1986 AT STREAMFLOW INDEX STATIONS

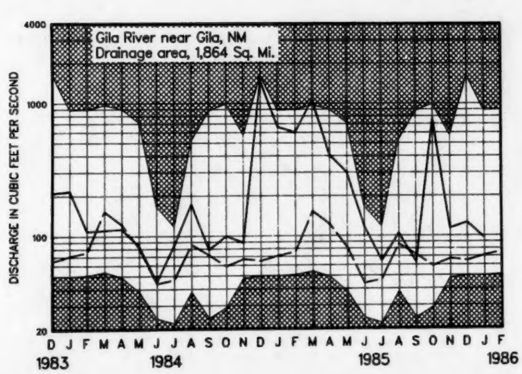
Station number	Stream and place of determination	Drainage area (square miles)	Years of record	Previous January extremes (period of record)		January 1986			
				Monthly mean in cfs (year)	Daily mean in cfs (year)	Monthly mean in cfs	Percent of median	Daily mean in cfs	Day
				HIGH FLOWS					
04071000	Oconto River near Gillett, Wisconsin.	705	75	629 (1973)	900 (1946)	889	263	1,330	2
05288500	Mississippi River near Anoka, Minnesota.	19,100	55	8,252 (1972)	9,770 (1966)	8,269	182	9,340	10
09379500	San Juan River near Bluff, Utah.	23,000	72	3,220 (1966)	9,520 (1979)	3,376	358	3,560	1
15515500	Tanana River at Nenana, Alaska.	25,600	24	7,200 (1970)	7,400 (1976)	9,180	141	9,800	1
				LOW FLOWS					
16068000	East Branch of North Fork Wailua River near Lihue, Kauai, Hawaii.	6.27	74	15.7 (1977)	9.4 (1969)	11.1	24	9.6	28

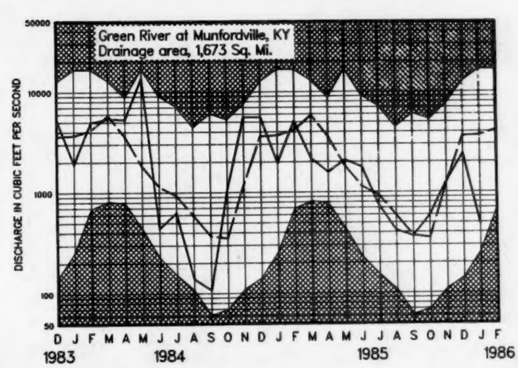
SURFACE WATER – MONTHLY MEAN DISCHARGE IN KEY STREAMS

Unshaded area indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951–80. Heavy line indicates mean for current period.







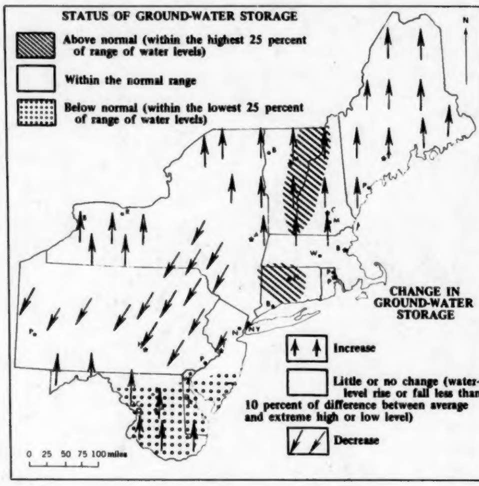


GROUND-WATER CONDITIONS DURING JANUARY 1986

Ground-water levels rose in most wells in northern and central New England during January, reversing the trend of the previous month. (See map.) Levels continued to rise in much of Maryland and Delaware, and also rose in western and northeastern New York State. Levels declined in central and eastern Pennsylvania and adjacent parts of New York and New Jersey. Near the end of January, levels remained below average in most of Delaware, southern New Jersey, and eastern and central Maryland. Above-average conditions persisted in central Connecticut, and levels also were above average in much of eastern Vermont and adjacent western New Hampshire.

In the southeastern States, ground-water levels rose in Arkansas and Louisiana, and declined in Kentucky; trends were mixed in other States. Water levels were above average in Kentucky, and below average in Arkansas. Levels were mixed with respect to average in other southeastern States. New low ground-water levels for January were recorded in Tennessee in the key well near Memphis, and in the key well in the Savannah area in the Coastal Plain of Georgia.

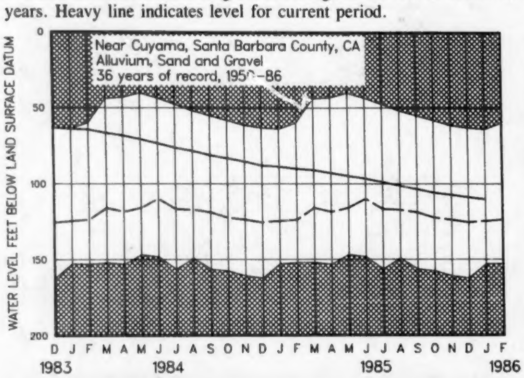
Among the central and western Great Lakes States, ground-water levels declined in Minnesota and Michigan, and showed mixed trends in Ohio and Iowa. Water levels were above average in Michigan, and average or near average in Indiana. Levels were mixed with respect to average in Minnesota and Iowa. A new high ground-water level for January was recorded in Michigan, despite a net decline during the month.

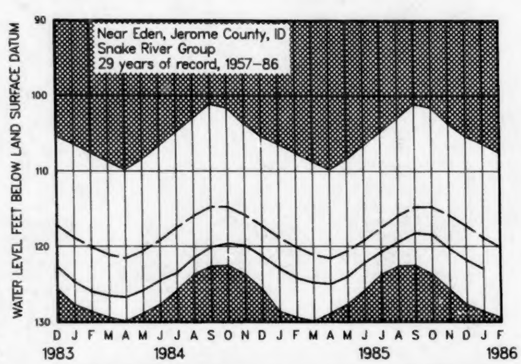


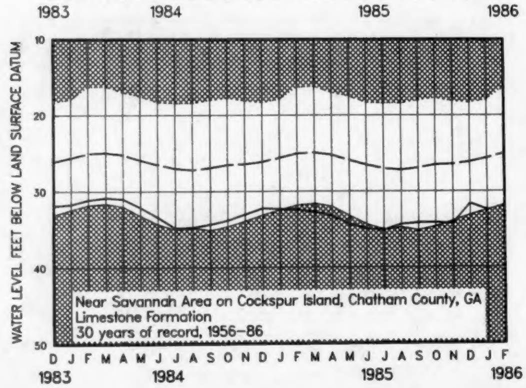
Map showing ground-water storage near end of January and change in ground-water storage from end of December to end of January.

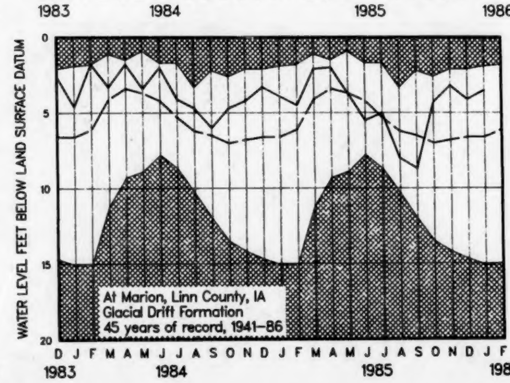
MONTH-END GROUND-WATER LEVELS IN KEY WELLS

Unshaded area indicates range between highest and lowest record for the month. Dashed line indicates average of monthly levles in previous years. Heavy line indicates level for current period.









Provisional data; subject to revision

WATER LEVELS IN KEY OBSERVATION WELLS IN SOME REPRESENTATIVE AQUIFERS IN THE CONTERMINOUS UNITED STATES—JANUARY 1986

Aquifer and Location	Water level in feet with reference to land-surface datum	Departure from average in feet	Net change in water level in feet since:		Year records began	Remarks
			Last month	Last year		
Glacial drift at Hanska, south-central Minnesota.	−8.30	+0.55	−2.18	−0.30	1942	
Glacial drift at Roscommon in north-central part of Lower Peninsula, Michigan.	−4.05	+0.86	−0.35	−0.05	1935	
Glacial drift at Marion, Iowa........................	−3.50	+2.88	+0.64	+0.49	1941	
Glacial drift at Princeton in northwestern Illinois.	−8.15	+4.93	−1.77	−0.40	1943	
Petersburg Granite, southeastern Piedmont near Fall Zone, Colonial Heights, Virginia.	−14.31	+0.88	−0.81	+3.00	1939	
Glacial outwash sand and gravel, Louisville, Kentucky (U.S. well no. 2).	−17.50	+8.06	−0.21	−0.64	1946	
500-foot sand aquifer near Memphis, Tennessee (U.S. well no. 2).	−104.34	−15.29	+0.16	−0.24	1941	January low.
Granite in eastern Piedmont Province, Chapel Hill, North Carolina (U.S. well no. 5).	−41.90	+1.24	+0.20	−1.14	1931	
Sparta Sand in Pine Bluff industrial area, Arkansas.	−217.35	−19.84	+3.15	+11.65	1958	
Eutaw Formation in the City of Montgomery, Alabama (U.S. well no. 4).	−23.0	−2.7	+0.2	−2.8	1952	
Limestone aquifer on Cockspur Island, Savannah area, Georgia (U.S. well no. 6).	−32.36	+6.50	+0.76	+0.10	1956	January low.*
Sand and gravel in Puget Trough, Tacoma, Washington.	−101.98	+7.42	−0.02	−2.10	1952	
Pleistocene glacial outwash gravel, North Pole, northern Idaho (U.S. well no. 3).	−461.1	−0.1	−0.5	−4.5	1929	
Snake River Group: Snake River Plain Aquifer, at Eden, Idaho (U.S. well no. 4).	−123.0	−4.1	−1.2	−0.1	1957	
Alluvial valley fill in Flowell area, Millard County, Utah (U.S. well no. 9).	−3.99	+21.88	+0.28	−5.19	1929	
Alluvial sand and gravel, Platte River Valley, Ashland, Nebraska (U.S. well no. 6).	−5.55	+0.34	−0.35	−0.64	1935	
Alluvial Valley fill in Steptoe Valley, Nevada.	−7.46	+5.36	+0.32	+0.65	1950	Alltime high.
Pleistocene terrace deposits in Kansas River valley, at Lawrence, northeastern Kansas.	−17.10	+4.16	−0.66	+3.23	1953	
Alluvium and Paso Robles clay, sand, and gravel, Santa Maria Valley, California	−110.04	+33.36	+25.27	+13.68	1957	
Valley fill, Elfrida area, Douglas, Arizona (U.S. well no. 15).	−104.6	−25.53	+0.2	+1.4	1951	
Hueco bolson, El Paso area, Texas................	−263.20	−17.55	+1.86	−1.88	1965	January low.
Evangeline aquifer, Houston area, Texas.........	−312.57	−15.56	+1.13	−6.06	1965	

**November high*, in this column for this well (U.S. well no. 6, Georgia) in the November 1985 issue, should read *November low*.

In the western States, ground-water levels rose in Nevada, declined in Washington, and declined in most of the key wells in Idaho. Trends were mixed in other western States. Levels were above average in Nebraska, southern California, and Utah, and below average in North Dakota. Levels were mixed with respect to average in other western States. A new high water level for January was recorded in the Blanding area of Utah, despite a net decline in level during the month. New low levels for January were reported also in key wells in Kansas, New Mexico, and, in spite of a net rise during the month, in western Texas. New alltime high ground-water levels were reached in the key well in the Steptoe Valley in Nevada, in 36 years of record, and in the Berrendo-Smith well in New Mexico, in 20 years of record.

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF JANUARY 1986

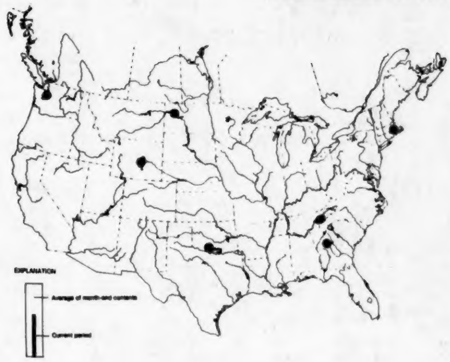
[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

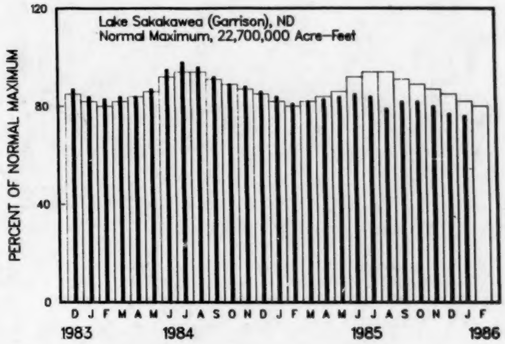
Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	Percent of normal maximum				Normal maximum[a] (acre-feet)
	End of Jan. 1986	End of Jan. 1985	Average for end of Jan.	End of Dec. 1985	
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs(P)	...	23	57	21	[b]226,300
QUEBEC					
Allard (P)	52	59	46	78	280,600
Gouin (P)	66	73	59	77	6,954,000
MAINE					
Seven reservoir systems (MP)	56	29	49	50	4,107,000
NEW HAMPSHIRE					
First Connecticut Lake (P)	30	42	36	35	76,450
Lake Francis (FPR)	46	51	51	61	99,310
Lake Winnipesaukee (PR)	73	45	57	60	165,700
VERMONT					
Harriman (P)	49	66	47	63	116,200
Somerset (P)	56	74	59	73	57,390
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	83	59	70	78	77,920
NEW YORK					
Great Sacandaga Lake (FPR)	62	39	45	69	786,700
Indian Lake (FMP)	77	75	54	81	103,300
New York City reservoir system (MW)	79	53	84	74	1,680,000
NEW JERSEY					
Wanaque (M)	76	47	75	99	85,100
PENNSYLVANIA					
Allegheny (FPR)	29	42	30	32	1,180,000
Pymatuning (FMR)	89	80	83	107	188,000
Raystown Lake (FR)	68	67	55	68	761,900
Lake Wallenpaupack (PR)	66	50	52	70	157,800
MARYLAND					
Baltimore municipal system (M)	72	92	86	72	261,900
NORTH CAROLINA					
Bridgewater (Lake James) (P)	87	87	79	92	288,800
Narrows (Badin Lake) (P)	90	82	96	82	128,900
High Rock Lake (P)	18	24	67	32	234,800
SOUTH CAROLINA					
Lake Murray (P)	79	79	65	82	1,614,000
Lakes Marion and Moultrie (P)	67	63	69	67	1,862,000
SOUTH CAROLINA—GEORGIA					
Clark Hill (FP)	66	54	60	73	1,730,000
GEORGIA					
Burton (PR)	72	61	58	83	104,000
Sinclair (MPR)	88	89	82	88	214,000
Lake Sidney Lanier (FMPR)	50	54	54	52	1,686,000
ALABAMA					
Lake Martin (P)	72	70	68	72	1,375,000
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	26	29	34	21	2,229,300
Douglas Lake (FPR)	11	12	14	12	1,394,000
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	46	38	42	50	1,012,000
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	37	35	34	41	2,880,000
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	33	34	40	35	1,478,000
WISCONSIN					
Chippewa and Flambeau (PR)	50	64	44	67	365,000
Wisconsin River (21 reservoirs) (PR)	63	57	34	78	399,000
MINNESOTA					
Mississippi River headwater system (FMR)	20	18	20	25	1,640,000
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	76	84	82	77	22,700,000
SOUTH DAKOTA					
Angostura (I)	50	72	74	49	127,600
Belle Fourche (I)	29	64	49	23	185,200
Lake Francis Case (FIP)	64	65	65	58	4,834,000
Lake Oahe (FIP)	77	83		73	22,530,000
Lake Sharpe (FIP)	98	99	98	100	1,725,000
Lewis and Clarke Lake (FIP)	94	93	93	93	477,000

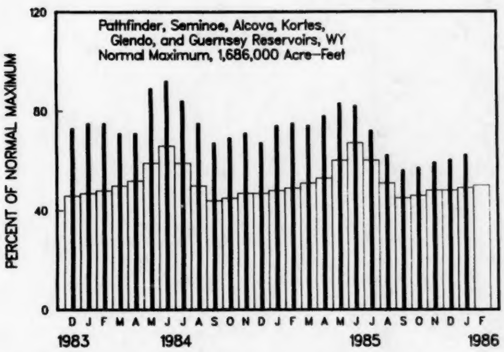
Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	Percent of normal maximum				Normal maximum[a] (acre-feet)
	End of Jan. 1986	End of Jan. 1985	Average for end of Jan.	End of Dec. 1985	
NEBRASKA					
Lake McConaughy (IP)	82	81	72	80	1,948,000
OKLAHOMA					
Eufaula (FRP)	94	101	83	104	2,378,000
Keystone (FPR)	81	94	86	102	661,000
Tenkiller Ferry (FPR)	103	109	90	115	628,200
Lake Altus (FIMR)	23	8	47	20	133,000
Lake O'The Cherokees (FPR)	90	92	79	102	1,492,000
OKLAHOMA—TEXAS					
Lake Texoma (FMPRW)	92	94	87	92	2,722,000
TEXAS					
Bridgeport (IMW)	78	68	46	79	386,400
Canyon (FMR)	98	88	78	100	385,600
International Amistad (FIMPW)	72	68	85	84	3,497,000
International Falcon (FIMPW)	30	36	75	40	2,668,000
Livingston (IMW)	101	101	87	105	1,788,000
Possum Kingdom (IMPRW)	89	95	95	91	570,200
Red Bluff (PI)	24	30	30	23	307,000
Toledo Bend (P)	90	89	84	99	4,472,000
Twin Buttes (FIM)	12	11	31	12	177,800
Lake Kemp (IMW)	92	78	85	93	268,000
Lake Meredith (FWM)	30	34	37	31	796,900
Lake Travis (FIMPRW)	94	86	80	95	1,144,000
MONTANA					
Canyon Ferry (FIMPR)	74	71	81	76	2,043,000
Fort Peck (FPR)	73	84	82	74	18,910,000
Hungry Horse (FIPR)	66	67	68	74	3,451,000
WASHINGTON					
Ross (PR)	57	48	54	68	1,052,000
Franklin D. Roosevelt Lake (IP)	100	85	83	63	5,022,000
Lake Chelan (PR)	42	35	45	57	676,100
Lake Cushman (PR)	64	41	81	40	359,500
Lake Merwin (P)	100	100	97	103	245,600
IDAHO					
Boise River (4 reservoirs) (FIP)	52	52	63	54	1,235,000
Coeur d'Alene Lake (P)	32	14	49	17	238,500
Pend Oreille Lake (FP)	40	33	54	43	1,561,000
IDAHO—WYOMING					
Upper Snake River (8 reservoirs) (MP)	55	67	66	36	4,401,000
WYOMING					
Boysen (FIP)	74	75	70	76	802,000
Buffalo Bill (IP)	64	72	65	65	421,300
Keyhole (F)	29	41	43	29	193,800
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	62	74	49	60	3,056,000
COLORADO					
John Martin (FIR)	89	76	17	85	364,400
Taylor Park (IR)	66	64	55	65	106,200
Colorado-Big Thompson project (I)	74	84	56	74	730,300
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	87	87	67	89	31,620,000
UTAH—IDAHO					
Bear Lake (IPR)	74	76	58	76	1,421,000[a]
CALIFORNIA					
Folsom (FIP)	72	59	55	58	1,000,000
Hetch Hetchy (MP)	49	41	33	51	360,400
Isabella (FIR)	36	43	27	34	568,100
Pine Flat (FI)	45	62	53	36	1,001,000
Clair Engle Lake (Lewiston) (P)	64	77	77	61	2,438,000
Lake Almanor (P)	67	79	51	63	1,036,000
Lake Berryessa (FIMW)	76	86	84	75	1,600,000
Millerton Lake (FI)	82	63	66	64	503,200
Shasta Lake (FIPR)	65	71	71	55	4,377,000
CALIFORNIA—NEVADA					
Lake Tahoe (IPR)	63	71	51	56	744,600
NEVADA					
Rye Patch (I)	66	65	58	60	194,300
ARIZONA—NEVADA					
Lake Mead and Lake Mohave (FIMP)	89	92	69	90	27,970,000
ARIZONA					
San Carlos (IP)	90	101	24	89	935,100
Salt and Verde River system (IMPR)	82	90	44	83	2,019,100
NEW MEXICO					
Conchas (FIR)	86	63	79	86	330,100
Elephant Butte and Caballo (FIPR)	92	70	33	88	2,453,000

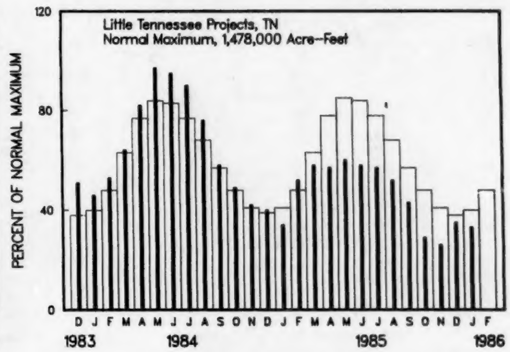
[a] 1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second day.
[b] Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

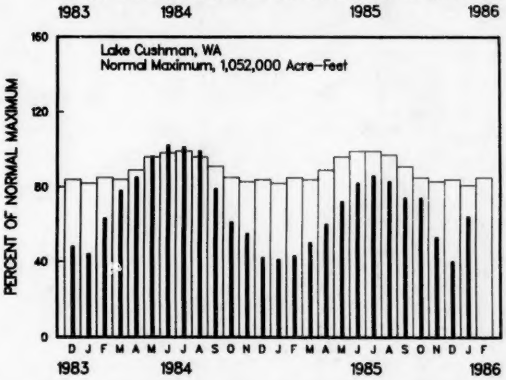
USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS, DECEMBER 1983 TO JANUARY 1986

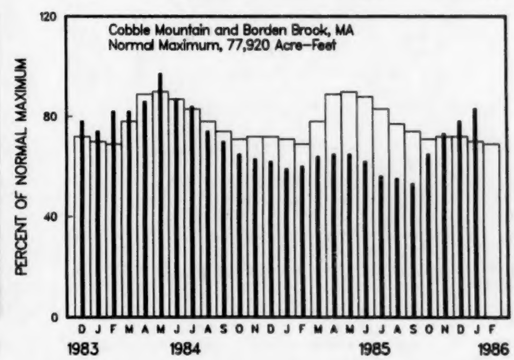


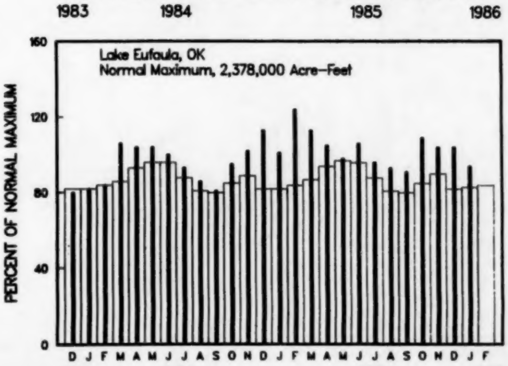


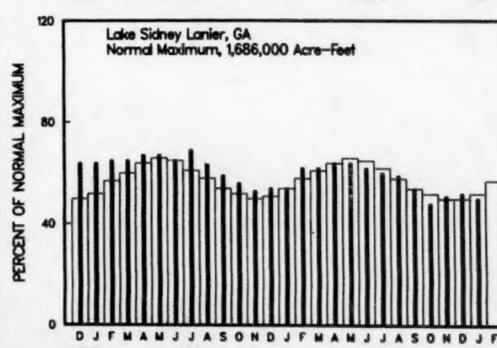












Provisional data; subject to revision

FLOW OF LARGE RIVERS DURING JANUARY 1986

Station number	Stream and place of determination	Drainage area (square miles)	Average discharge through September 1980 (cubic feet per second)	January 1986: Monthly mean discharge (cubic feet per second)	Percent of median monthly discharge, 1951–80	Change in discharge from previous month (percent)	Discharge near end of month: Cubic feet per second	Million gallons per day	Date
01014000	St. John River below Fish River at Fort Kent, ME.	5,690	9,647	2,740	97	−36	14,000	9,000	31
01318500	Hudson River at Hadley, NY	1,664	2,909	2,040	116	−22	2,480	1,602	31
01357500	Mohawk River at Cohoes, NY	3,456	5,734	4,360	97	−15	3,600	2,330	31
01463500	Delaware River at Trenton, NJ	6,780	11,750	11,010	105	−33	14,900	9,630	31
01570500	Susquehanna River at Harrisburg, PA.	24,100	34,530	26,900	78	−43	35,100	22,690	30
01646500	Potomac River near Washington, DC.	11,560	[1]11,490	[1]5,880	45	−66	5,410	3,496	31
02105500	Cape Fear River at William O. Huske Lock near Tarheel, NC	4,810	5,005	2,110	29	−69	4,080	2,636	31
02131000	Pee Dee River at Peedee, SC	8,830	9,851	5,470	39	−65	7,130	4,608	30
02226000	Altamaha River at Doctortown, GA	13,600	13,880	11,850	73	−54	11,800	7,630	27
02320500	Suwannee River at Branford, FL	7,880	6,987	12,500	248	+43	12,500	8,080	31
02358000	Apalachicola River at Chattahoochee, FL.	17,200	22,570	30,200	104	+44	17,300	11,180	31
02467000	Tombigbee River at Demopolis lock and dam near Coatopa, AL.	15,400	23,300	16,800	45	+0	6,600	4,270	29
02489500	Pearl River near Bogalusa, LA	6,630	9,768	5,016	51	−34	3,940	2,546	31
03049500	Allegheny River at Natrona, PA	11,410	[1]19,480	30,670	137	−31	43,400	28,050	27
03085000	Monongahela River at Braddock, PA	7,337	[1]12,510	12,120	64	−51	21,600	13,960	27
03193000	Kanawha River at Kanawha Falls, WV.	8,367	12,590	7,598	47	−46	9,610	6,211	27
03234500	Scioto River at Higby, OH	5,131	4,547	3,714	66	−62	3,150	2,035	31
03294500	Ohio River at Louisville, KY[2]	91,170	116,000	93,970	62	−57	212,800	137,540	26
03377500	Wabash River at Mount Carmel, IL	28,635	27,220	23,758	92	−73	18,300	11,830	31
03469000	French Broad River below Douglas Dam, TN.	4,543	6,798	3,081	36	−42	.....	.....	...
04084500	Fox River at Rapide Croche Dam, near Wrightstown, WI.[2]	6,150	4,163	3,329	91	+28	4,797	3,100	25
04264331	St. Lawrence River at Cornwall, Ontario–near Massena, NY.[3]	299,000	242,700	248,355	108	−9	284,000	183,600	31
02NG001	St. Maurice River at Grand Mere, PQ.	16,300	25,150	6,080	82	−45	20,700	13,380	31
05082500	Red River of the North at Grand Forks, ND.	30,100	2,551	1,890	170	−6	1,850	1,195	27
05133500	Rainy River at Manitou Rapids, MN	19,400	12,830	12,400	129	−20	11,800	7,630	27
05330000	Minnesota River near Jordan, MN	16,200	3,402	1,873	385	−30	1,930	1,247	31
05331000	Mississippi River at St. Paul, MN	36,800	[1]10,610	10,150	210	−14	8,700	5,620	31
05365500	Chippewa River at Chippewa Falls, WI.	5,600	5,100	4,417	148	−29	.....	.....	...
05407000	Wisconsin River at Muscoda, WI	10,300	8,617	9,552	158	−19	7,000	4,500	29
05446500	Rock River near Joslin, IL	9,551	5,873	7,460	204	−32	7,200	4,650	31
05474500	Mississippi River at Keokuk, IA	119,000	62,620	60,220	175	−5	54,100	34,970	31
06214500	Yellowstone River at Billings, MT	11,796	7,038	2,360	94	−25	2,310	1,492	31
06934500	Missouri River at Hermann, MO	524,200	79,490	59,387	178	−50	52,600	34,000	31
07289000	Mississippi River at Vicksburg, MS[4]	1,140,500	576,600	476,200	74	−60	403,000	260,500	27
07331000	Washita River near Dickson, OK	7,202	1,368	748	207	−36	747	482	22
08276500	Rio Grande below Taos Junction Bridge, near Taos, NM.	9,730	725	739	177	−14	750	484	31
09315000	Green River at Green River, UT	40,600	6,298	4,311	172	+18	4,340	2,805	21
11425500	Sacramento River at Verona, CA	21,257	18,820	15,320	54	+15	7,950	5,138	21
13269000	Snake River at Weiser, ID	69,200	18,050	16,500	100	−9	21,100	13,640	31
13317000	Salmon River at White Bird, ID	13,550	11,250	4,140	97	+3	4,920	3,179	31
13342500	Clearwater River at Spalding, ID	9,570	15,480	5,250	74	−51	11,720	7,574	31
14105700	Columbia River at The Dalles, OR[5]	237,000	[1]193,100	[1]79,000	91	+13	127,900	82,660	27
14191000	Willamette River at Salem, OR	7,280	[1]23,510	[1]37,600	65	+46	37,600	24,300	27
15515500	Tanana River at Nenana, AK	25,600	23,460	9,180	141	−15	8,600	5,560	31
08MF005	Fraser River at Hope, BC	83,800	96,290	27,718	79	+4	29,310	18,941	30

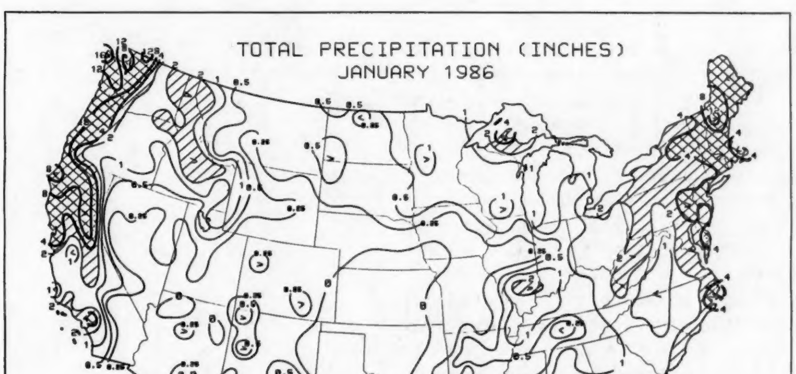
[1]Adjusted.
[2]Records furnished by Corps of Engineers.
[3]Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES, JANUARY 1986, AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	January data of following calendar years	Stream discharge during month: Mean (cfs)	Dissolved-solids concentration[a]: Minimum (mg/L)	Dissolved-solids concentration[a]: Maximum (mg/L)	Dissolved-solids discharge[a]: Mean (tons per day)	Dissolved-solids discharge[a]: Minimum (tons per day)	Dissolved-solids discharge[a]: Maximum (tons per day)	Water temperature[b]: Mean in °C	Water temperature[b]: Minimum, in °C	Water temperature[b]: Maximum, in °C
01463500	Delaware River at Trenton, NJ (Morrisville, PA).	1986	11,000	78	128	2,900	1,250	7,390	1.0	0	3.5
		1945—85	12,800	62	201	. . . . .	758	20,800	. . .	0	7.5
		(Extreme yr)		(1951, 1960)	(1959)		(1981)	(1976)			
			[c]10,440								
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, NY (median streamflow at Ogdensburg, NY).	1986	248,400	166	166	111,100	98,320	126,900	0.5	0.5	0.5
		1976—85	236,700	165	168	106,500	90,000	139,000	0.5	0	4.0
		(Extreme yr)		(1981, 1983, 1985)	(1976, 1977, 1979, 1980)		(1977, 1979)	(1980, 1982)			
			[c]228,900								
07289000	Mississippi River at Vicksburg, MS.	1986	476,200	192	277	318,873	205,821	457,062	4.5	3.0	6.5
		1976—85	650,900	157	299	292,700	128,000	619,000	3.0	0	10.0
		(Extreme yr)		(1979)	(1981)		(1981)	(1985)			
			[c]645,700								
03612500	Ohio River at lock and dam 53, near Grand Chain, IL (streamflow station at Metropolis, IL).	1986	166,000	163	215	. . . . .	48,100	131,000	. . .	2.0	3.5
		1955—85	361,800	98	382	. . . . .	28,500	448,000	. . .	0	10.0
		(Extreme yr)		(1973)	(1964)		(1956)	(1970)			
			[c]362,300								
06934500	Missouri River at Hermann, MO (60 miles west of St. Louis, MO).	1986	61,100	354	449	67,000	52,900	78,100	3.3	2.0	5.5
		1976—85	45,610	159	553	46,560	18,100	160,000	1.5	0	5.5
		(Extreme yr)		(1976)	(1977)		(1981)	(1985)			
			[c]33,290								
14128910	Columbia River at Warrendale, OR (streamflow station at The Dalles, OR).	1986	127,000	100	109	36,000	28,300	44,700	1.7	1.2	2.1
		1976—85	178,400	76	125	45,600	24,300	79,800	3.0	0	9.0
		(Extreme yr)		(1978)	(1983)		(1979)	(1984)			
			[c]86,480								

[a]Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1951—80, for comparison with data for current month.



STUDY AND INTERPRETATION OF THE CHEMICAL CHARACTERISTICS OF NATURAL WATER

The abstract and table are from the report, *Study and interpretation of the chemical characteristics of natural water*, by John D. Hem, U.S. Geological Survey Water-Supply Paper 2254, 264 pages, 1985.This report may be purchased for $12.00 from Eastern Distribution Branch, Text Products Section, U.S. Geological Survey, 604 S. Pickett St., Alexandria, VA 22304 (check or money order payable to U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (payable to Superintendent of Documents).

ABSTRACT

The chemical compositon of natural water is derived from many different sources of solutes, including gases and aerosols from the atmosphere, weathering and erosion of rocks and soil, solution or precipitation reactions occurring below the land surface, and cultural effects resulting from human activities. Broad interrelationships among these processes and their effects can be discerned by application of principles of chemical thermodynamics. Some of the processes of solution or precipitation of minerals can be closely evaluated by means of principles of chemical equilibrium, including the law of mass action and the Nernst equation. Other processes are irreversible and require consideration of reaction mechanisms and rates. The chemical composition of the crustal rocks of the Earth and the composition of the ocean and the atmosphere are significant in evaluating sources of solutes in natural freshwater.

The ways in which solutes are taken up or precipitated and the amounts present in solution are influenced by many environmental factors, especially climate, structure and position of rock strata, and biochemical effects associated with life cycles of plants and animals, both microscopic and macroscopic. Taken together and in application with the further influence of the general circulation of all water in the hydrologic cycle, the chemical principles and environmental factors form a basis for the developing science of natural-water chemistry.

Fundamental data used in the determination of water quality are obtained by the chemical analysis of water samples in the laboratory or onsite sensing of chemical properties in the field. Sampling is complicated by changes in the composition of moving water and by the effects of particulate suspended material. Some constituents are unstable and require onsite determination or sample preservation. Most of the constituents determined are reported in gravimetric units, usually milligrams per liter or milliequivalents per liter (see table 1).

More than 60 constituents and properties are included in water analyses frequently enough to provide a basis for consideration of the sources from which each is generally derived, the most probable forms of elements and ions in solution, solubility controls, expected concentration ranges, and other chemical factors. Mechanisms that control concentrations of elements commonly present in amounts less than a few tens of micrograms per liter cannot always be easily ascertained, but present information suggests that many are controlled by solubility of their hydroxides or carbonates or by sorption on solid particles. Many dissolved organic compounds can now be specifically determined.

Chemical analyses may be grouped and statistically evaluated by means, medians, frequency distributions, or ion correlations to summarize large volumes of data. Graphing of analyses or of groups of analyses aids in showing chemical relationships among water, probable sources of solutes, areal water-quality regimen, temporal and spatial variation, and water-resources evaluation. Graphs may show water type based on chemical composition, relationships among ions, or groups of ions in individual waters or many waters considered simultaneously. The relationships of water quality to hydrogeologic characteristics, such as stream discharge rate or ground-water flow patterns, can be shown by mathematical equations, graphs, and maps.

About 80 water analyses selected from the literature are tabulated to illustrate the relationships described, and some of these, along with many others that are not tabulated, are also used in demonstrating graphing and mapping techniques.

Relationships of water composition to source rock type are illustrated by graphs of some of the tabulated analyses. Human activities may modify water composition extensively through direct effects of pollution and indirect results of water development, such as intrusion of seawater in ground-water aquifers.

Water-quality standards for domestic, agricultural, and industrial use have been published by various agencies. Irrigation project requirements for water quality are particularly intricate.

Fundamental knowledge of processes that control natural-water composition is required for rational management of water quality.

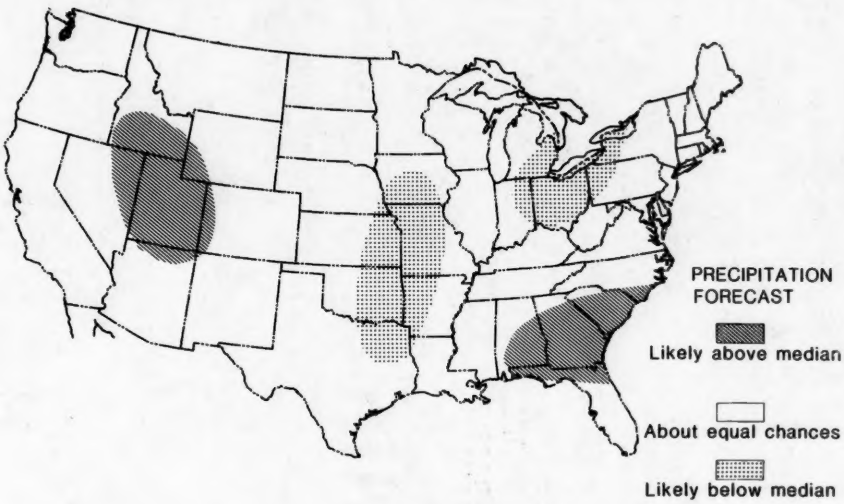
Table 1. Composition of river water

[Date under sample number is date of collection. Sources of data: 1, Oltman (1968, p. 13); 2, U.S. Geological Survey Water-Supply Paper 1964; 3, Livingstone (1963, p. G41); 4, Maybeck (1979)]

Constituent	1		2		3		4	
	July 16, 1963		Oct. 1, 1964 - Sept. 30, 1965					
	mg/L	meq/L	mg/L	meq/L	mg/L	meq/L	mg/L	meq/L
Silica (SiO_2)	7.0		7.9		13		10.4	
Aluminum (Al)	.07							
Iron (Fe)	.06		.02					
Calcium (Ca)	4.3	.215	38	1.896	15	.749	13.4	.669
Magnesium (Mg)	1.1	.091	10	.823	4.1	.337	3.35	.276
Sodium (Na)	1.8	.078	20	.870	6.3	.274	5.15	.224
Potassium (K)			2.9	.074	2.3	.059	1.3	.033
Bicarbonate (HCO_3)	19	.311	113	1.852	58	.951	52	.852
Sulfate (SO_4)	3.0	.062	51	1.062	11	.239	8.25	.172
Chloride (Cl)	1.9	.054	24	.677	7.8	.220	5.75	.162
Fluoride (F)	.2	.011	.3	.016				
Nitrate (NO_3)	.1	.002	2.4	.039	1	.017		
Dissolved solids	28.		232		89		73.2	
Hardness as $CaCO_3$	15		138		54		47	
Noncarbonate	0		45		7		5	
Specific conductance (micromhos at 25°C).	40		371					
pH	6.5		7.4					
Color			10					
Dissolved oxygen	5.8							
Temperature (°C)	28.4							

1. Amazon at Obidos, Brazil. Discharge, 216,000 m^3/s (7,640,000 cfs) (high stage).
2. Mississippi at Luling Ferry, La. (17 mi west of New Orleans). Time-weighted mean of daily samples.
3, 4. Mean composition of river water of the world (estimated). Dissolved-solids computed as sum of solute concentrations, with HCO_3 converted to equivalent amount of CO_3.

PRECIPITATION FORECAST FOR FEBRUARY TO APRIL 1986



(From Monthly and Seasonal Weather Outlook Published by National Weather Service)

NATIONAL WATER CONDITIONS

January 1986

Based on reports from the Canadian and U.S. Field offices; completed February 19, 1986

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EXPLANATION OF DATA (Revised January 1986)

Cover map shows generalized pattern of streamflow for the month based on provisional data from 184 index gaging stations—18 in Canada, 164 in the United States, and 2 in the Commonwealth of Puerto Rico. Alaska and Hawaii inset maps show streamflow only at the index gaging stations that are located near the point shown by the arrows. Classifications on map are based on comparison of streamflow for the current month at each index station with the flow for the same month in the 30-year reference period, 1951-80. Shorter reference periods are used for one Canadian index station, two Kansas index stations, one New York index station, and the Puerto Rico index stations because of the limited records available.

The comparative data are obtained by ranking the 30 flows for each month of the reference period in order of decreasing magnitude—the highest flow is given a ranking of 1 and the lowest flow is given a ranking of 30. Quartiles (25-percent points) are computed by averaging the 7th and 8th highest flows (upper quartile), 15th and 16th highest flows (middle quartile and median), and the 23rd and 24th highest flows (lower quartile). The upper and lower quartiles set off the highest 25 percent of flows and lowest 25 percent of flows, respectively, for the reference period. The median (middle quartile) is the middle value by definition. For the reference period, 50 percent of the flows are greater than the median, 50 percent are less than the median, 50 percent are between the upper and lower quartiles (in the normal range) 25 percent are greater than the upper quartile (above normal), and 25 percent are less than the lower quartile (below normal). Flow for the current month is then classified as; *above normal* if it is greater than the upper quartile, *in the normal range* if it is between the upper and lower quartiles, and *below normal* if it is less than the lower quartile. Change in flow from the previous month to the current month is classified as *seasonal* if the change is in the same direction as the change in the median. If the change is in the opposite direction of the change in the median, the change is classified as *contraseasonal* (opposite to the seasonal change). For example: at a particular index station, the January median is greater than the December median; if flow for the current January increased from December (the previous month), the increase is seasonal; if flow for the current January decreased from December, the decrease is contraseasonal.

Flood frequency analyses define the relation of flood peak magnitude to probability of occurrence or recurrence interval. *Probability of occurrence* is the chance that a given flood magnitude will be exceeded in any one year. *Recurrence interval* is the reciprocal of probability of occurrence and is the *average* number of years between occurrences. For example, a flood having a probability of occurrence of 0.01 (1 percent) has a recurrence interval of 100 years. *Recurrence intervals imply no regularity of occurrence;* a 100-year flood might be exceeded in consecutive years or it might not be exceeded in a 100-year period.

Statements about *ground-water levels* refer to conditions near the end of the month. The water level in each key observation well is compared with average level for the end of the month determined from the 30-year reference period, 1951-80, or from the entire past record for that well when only limited records are available. Comparative data for ground-water levels are obtained in the same manner as comparative data for streamflow. *Changes in ground-water levels,* unless described otherwise, are from the end of the previous month to the end of the current month.

Dissolved solids and temperature data for January are given for six stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). *Dissolved solids* are minerals dissolved in water and usually consist predominately of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. *Dissloved-solids discharge* represents the total daily amount of dissolved minerals carried by the stream. *Dissolved-solids concentrations* are generally higher during periods of low streamflow, but the highest dissolved-solids *discharges* occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

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